DCCUMENT RESUME

ED 153 781 SE 022 459

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TITLE Application of Bales Interperscnal Mcdel tc Science Teaching.
PUB DATE Mar 77
NOTE 15p.; Paper presented at the annual meeting of the National Associatien fcr Research in Scierce Teaching (50th, Cincinnati, Chic, March 22-24, 1977); Contains marginal legibility in Figures and Tables

EDRS PRICE MF-$0.83 HC-$1.67 Plus Pcstage.
DESCRIPTORS *Educational Research; *Measurement Instruments; Science Educatien; Secendary Grades; *Secendary School Science; *Student Teacher Relaticnship; *Teacher Behavior
IDENTIFIERS *Bales Interperscnal Mcdel

ABSTRACT

The primary objective cf this study was tc use factor analytic techniques to test the hypcthesized threes dimensional crthcgonal structure of the Bales interperscnal role mcdel when applied to science teachers. A secend chjective was the development of ccmputer programs capable of quickly prccessing classrccm data and providing summarized data for interpretatien of results to teachers and interns. Student teachers in urban and suburban sites were selected for the study. The final sample included primarily suburban high schccl students in 31 classes of 12 student teachers. The data are discussed and implicatiens and ccmments are presented. Based cn this study, further work is reccmmended tc inprcve the instrument. Work being dcne is indicated. (RH)

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APPLICATION OF BALES INTERPERSONAL MODEL

TO

SCIENCE TEACHING

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A Paper Prepared for the Meeting of the
National Associaltion for Research in Science Teaching

Cincinnati, Ohio
24 March 1977

SE 022 459

Most supervisors working with student teachers would agree that rapport between the intern and students is critical to success in student teaching. However, "rapport" is a rather vague term in the context of competency/performance based teacher education programs which require objective definitions for feedback and evaluation. During the past decade several observation instruments which count and catagorize specific teacher behaviors have been developed. Although these low inference instruments provide reliable and objective measures, they have several important limitations in practical teacher training situations. First, the enormous effort required to obtain and process the data generally permits only a very restricted sample of teacher behavior. Second, it is difficult for an outside observer to assess the context of a specific teacher act. For example, the significance of praise depends upon the frequency and critical judgement with which it is applied. Indeed, failure to praise may be the significant act for a teacher who praises constantly regardless of the quality of the student response. Third, the most significant interpersonal interactions may be nearly impossible to observe since they often occur outside the classroom, may be of very short duration, or may simply represent failure to react meaningfully to important events in students lives. For example, an altercation during lunchroom duty, a disapproving look when the student enters the class, or failure to recognize success or tragedy which the student encounters in his life. Finally, there is a need for comprehensive models which identify, in a theoretically coherent and parsimonious manner, the variety of interpersonal roles which teachers can assume with various students.

Many of these problems can be overcome by the use of high inference measures which use students as observers. Although these measures produce more subjective data, the individual student has a complete sample of the student-teacher interaction and is keenly aware of the context of each teacher act directed to him. If the student is viewed as the focus of teaching, his perception should be of great interest to the teacher. We believe that individual student perceptions of teacher classroom role should provide a potent teacher development tool for they provide a framework from which to examine, recall, and speculate on specific teacher interaction and behavior patterns which produce divergent results with different students. Bales (1970) has extensively studied small groups of college students in task oriented groups and provides a promising theoretical foundation for the development of a classroom interpersonal role model for teachers.

Bales has proposed a three dimensional orthogonal model which defines twenty-seven distinct roles which individuals can assume in task oriented small groups. Figure 1 demonstrates how the three primary dimensions of dominance, friendliness, and task orientation which define the model can be combined to represent the twenty-seven group roles. A detailed discussion of each role is given by Bales. A previous factor analytic study (Bates, 1974) demonstrated

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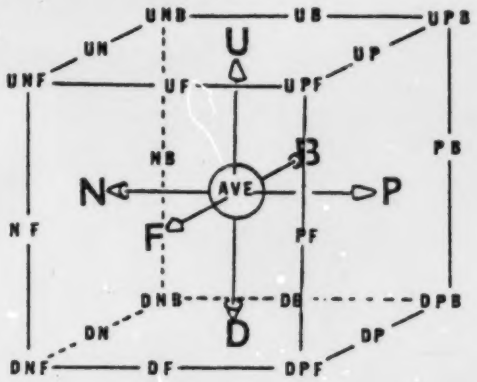
Figure 1.

Three orthogonal dimensions of Dominance (U-D), Friendliness (P-N), and Task Orientation (F-B) define the interpersonal factor space proposed by Bales. Twenty-seven direction indicators are defined by various combinations of the three major dimensions. These direction indicators represent different possible behavior roles which an individual may assume in a small group.



that three factors congruent with dominance, friendliness, and task orientation can account for a significant proportion of the variance (31%) among diverse measures representing selected characteristics of teachers, students, class structure, and classroom climate. The purpose of the current study was to develop a preliminary instrument based on Bales methodology and instruments to test the applicability of this model for describing teacher classroom interpersonal role. Two statements characteristic of behavior related to each region of the hypothesized interpersonal space were selected for each of the twenty-six nonzero direction indicators. The items are reproduced in Table I. Students responded on a five point scale (strongly agree . . . strongly disagree) as to their perception of the degree to which each item described their teacher. Thirteen dipolar scales with a raw score range from -8 to +8 were created from the four items representing opposing directions in the hypothesized interpersonal space. These fifty-two items were part of a larger instrument (134 items) which included questions on classroom climate and structure.

Sample

Student teachers in urban and suburban sites were selected for the study. Student teachers were used since it was believed that they would exhibit more variable role behavior. Approximately one half the field sites returned materials. Of the 700 student answer sheets, 566 were completed in a reasonable manner and included in the study. The final sample was composed almost entirely of suburban high school students from 31 classes of 12 student teachers. This selection procedure certainly biases the data, but it was felt reasonable for an initial test of the hypothsized structure of the instrument.

UPWARD PLANE

UMB: Toward Rugged Individualism and Gratification

7. Does s/he seem to demand a lot of attention and admiration?

33. Does s/he seem to feel that students are generally too conforming to school rules?

UB: Toward Value-Relativism and Expression

8. Does s/he receive a lot of laughter in response to jokes?

34. Does s/he make many jokes or entertain by dramatic stories or acts?

UPb: Toward Emotional Supportiveness and Warmth

9. Does s/he actively try to make students feel happy and friendly?

35. Does s/he think up unconventional ways of increasing positive feeling in the class?

UM: Toward Tough-Minded Assertiveness

6. Does s/he seem to make students feel s/he dislikes them?

32. Is his or her rate of disagreement generally high?

U: Toward Material Success and Power

1. Does s/he receive a lot of interaction from students?

27. Is his or her rate of participation generally very high?

UP: Toward Social Success

2. Does s/he arouse both your admiration and liking?

28. Do you guess s/he has a picture of herself or himself as socially popular?

UNF: Toward Autocratic Authority

5. Does s/he expect students to be obedient and respect authority?

31. Does s/he often make demands or want to enforce discipline?

UF: Toward Group Loyalty and Cooperation

4. Does s/he assume responsibilities expected of a teacher?

30. Does s/he actively help students with school work?

UFF: Toward Social Solidarity and Progress

3. Does s/he seem personally involved in helping the class to cooperate?

29. Does s/he often ask students for their opinion on class matters?

FB/PN PLANE

MB: Toward Rejection of Social Conformity

15. Does s/he seem pessimistic?

41. Does s/he seem cynical?

B: Toward Rejection of Conservative Group Belief

16. Does s/he often come to class unprepared?

42. Does s/he often appear uninterested in teaching?

FB: Toward Permissive Liberalism

17. Does s/he feel that friendship is more important than achievement?

43. Does s/he feel that being liked is more important than getting the job done?

M: Toward Individualistic Isolation

14. Does s/he tend to believe that students dislike her/him?

40. Does s/he seem somewhat unfriendly?

AVE: Toward a Balanced Average of All Directions

F: Toward Equalitarianism

10. Does s/he seem warm and personal?

36. Does s/he seem to be able to give a lot of affection?

NF: Toward Value-Determined Restraint

13. Does s/he seem to be rather cold and formal?

39. Does s/he persistently emphasize moderation, caution, restraint?

F: Toward Conservative Group Beliefs

12. Is s/he very strongly work-oriented?

38. Does s/he tend mostly to give opinion or analysis when working with students?

PF: Toward Altruistic Love

11. Does s/he seem to be dependably idealistic and kind?

37. Does s/he seem to be agreeable, understanding?

DOWNWARD PLANE

MMB: Toward Failure and Withdrawal

23. Does s/he tend to be somewhat depressed or withdrawn?

49. Does s/he often seem uncooperative when students ask for help?

DB: Toward Withholding of Cooperation

24. Is s/he often unavailable to students during class?

50. Does s/he often avoid students?

DPB: Toward Identification with the Underprivileged

25. Does s/he ask the class to accept and help students who have difficulty in school?

51. Does s/he speak gently and sympathetically in defense of others?

DM: Toward Rejection of Social Success

22. Does s/he show many signs of passive resistance to student's friendship?

48. Does s/he seem to be silently resentful of others popularity?

D: Toward Devaluation of the Self

26. Does s/he seldom interact with students?

52. Does s/he seem very quiet, introverted, introspective?

DP: Toward Trust in the Goodness of Others

18. Does s/he seem quietly good-natured?

44. Does s/he seem both quiet and likable?

DNF: Toward Self-Sacrifice for Values

21. Does s/he seem anxious to be approved by authority such as the principal or supervisor?

47. Does s/he try to make other people feel sorry for her/him?

DF: Toward Self-Knowledge and Subjectivity

20. Does s/he seem to carefully follow school rules?

46. Does s/he seem cautious, dutiful, and conventional?

DFF: Toward Salvation through Love

19. Does s/he seem to be quiet but helpful to students

45. Does s/he seem to be a kind and devoted teacher?

Results

The instrument can be shown to have construct validity if the empirical factor structure is congruent with the hypothesized interpersonal factor space shown in Figure 1. A principal componants factor analysis demonstrated that three orthogonal factors consistent with the hypothesized dimensions of friendliness, task orientation, and dominance account for 65% of the total variance among the 13 dipolar scales representing the twenty-six regions of Bales interpersonal space. Results of the factor analysis are reported in Table II and factor plots are given in Figure 2.

Perfect congruence between the empirical and hypothesized models would exist if each of the three factors accounted for 33% of the total variance and if each of the thirteen dipolar directions were oriented as shown in Figure 1. This is, of course, an extremely rigorous criteria. The first factor includes 44% of the total variance which is approximately two thirds of the variance accounted for in the empirical model. This suggests a strong "teaching" factor which confounds the effects of the three hypothesized dimensions. The subscales which represent combinations of teacher characteristics commonly accepted as "desirable" are highly positively loaded on this factor and those commonly thought of as "undesirable" have large negative loadings. These results are summarized in Table III.

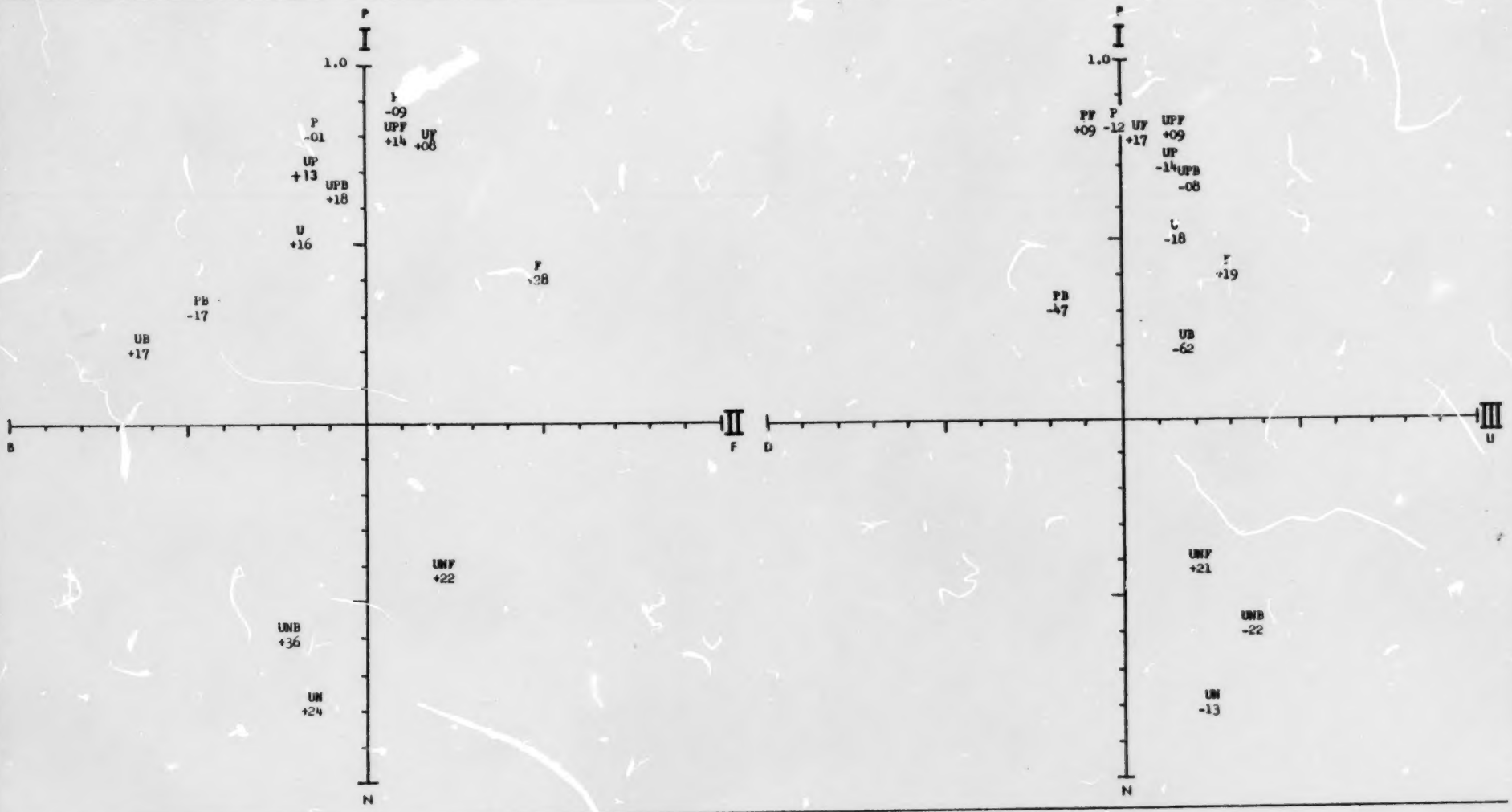
Table III. Dipolar scales which load heavily on Factor I.

Factor Loading	Scale		Description		
+.83	S11	.PF-NB.	friendly + task oriented	vs	unfriendly + task avoiding
+.82	S10	..P-N..	friendly	vs	unfriendly
+.81	S03	UPF-DNB	active + friendly + task oriented	vs	passive + unfriendly + task avoiding
+.80	S04	.UF-DB.	active + task oriented	vs	passive + task avoiding
-.59	S07	UNB-DPF	active + unfriendly + task avoiding	vs	passive + friendly + task oriented
-.79	S06	.UN-DP.	active + unfriendly	vs	passive + friendly

Table II. Subscale Statistics and Factor Analysis.

Scale	Mean	Std Dev	∝ Rel	Principal Components Factor Analysis			
				Communality	loading (dir cos/hypothesized dir cos)		
					F1	F2	F3
S01 ..U-D..	2.4	2.6	.39	.33	51 (89/ 00)	-18 (-31/ 00)	16 (28/100)
S02 .UP-DN.	1.7	2.6	.37	.54	71 (97/ 71)	-14 (-19/ 00)	13 (18/ 71)
S03 UPF-DNB	3.5	3.0	.61	.67	81 (99/ 58)	09 (11/ 58)	14 (17/ 58)
S04 .UF-DB.	3.7	3.2	.69	.67	80 (98/ 00)	17 (21/ 71)	08 (10/ 71)
S05 UNF-DPB	1.2	2.3	.11	.26	-41 (-80/-58)	21 (41/ 58)	22 (43/ 58)
S06 .UN-DP.	-2.8	2.9	.60	.70	-79 (-94/-71)	-13 (-16/ 00)	25 (30/ 71)
S07 UNB-DPF	-2.3	2.6	.36	.52	-59 (-82/-58)	-22 (-31/-58)	36 (50/ 58)
S08 .UB-DF.	-1.6	2.8	.38	.47	22 (32/ 00)	-62 (-90/-71)	17 (25/ 71)
S09 UPB-DNF	1.5	2.7	.40	.51	68 (95/ 58)	-08 (-11/-58)	18 (25/ 58)
S10 ..P-N..	2.0	3.2	.72	.69	82 (99/100)	-12 (-14/ 00)	-01 (-01/ 00)
S11 .PF-NB.	3.1	3.0	.67	.70	83 (99/ 71)	09 (11/ 71)	-09 (11/ 00)
S12 ..F-B..	3.0	2.6	.36	.50	42 (59/ 00)	49 (69/100)	29 (41/ 00)
S13 .PB-NF.	-0.4	2.2	.18	.35	32 (54/ 71)	-47 (-79/-71)	-17 (-29/ 00)
				Latent Roots	5.76	1.63	1.03
				Total 65%	(44%)	(13%)	(8%)

Figure 2.


P
I
1.0
P
-01
UP
+13
UPB
+18
U
+16
UB
+17
PB
-17
P
-09
UPF
+14
UF
+08
F
+28
UNF
+22
UNB
+36
UN
+24
B
II
F
N
P
I
1.0
PF
+09
P
-12
UF
+17
UPF
+09
UP
-14
UPB
-08
U
-18
F
+19
PB
-47
UB
-62
UNF
+21
UNB
-22
UN
-13
D
III
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N

This strong common factor is reflected in the factor plots by the clustering of roles along Factor I rather than an even distribution throughout the space as shown in Figure 1. Although most of the hypothesized interpersonal roles are not located in the specific position predicted by the model, none violate the basic hypothesized structure. If Factor I is interpreted as the "friendliness" dimension (P-N), Factor II as the "task orientation" dimension (F-B), and Factor III as the "dominance" dimension (U-D), all roles are found in the proper region of the space. That is, all those dipolar scales with a "friendly" component (P), such as P, UP, UPB, PF, UPF, etc., are positively loaded on the P-N dimension while those with an "unfriendly" component (N), such as UNB, UN, UNF, are negatively loaded on the P-N dimension. The same pattern exists for interpersonal roles with components which are "task oriented" (F) or "task avoiding" (B) as well as "active" (U) or "passive" (D). This pattern is also shown in Table II where the direction cosines for each subscale is compared with the hypothesized direction cosines predicted by the model.

The direction cosine gives the direction of the vector in the factor space associated with each subscale and is independent of the length of the vector. The direction cosine is calculated by dividing each factor loading by the length of the subscale vector which is given by the square root of the communality. This can easily be derived from the definition of the cosine function and the Pythagorean theorem which states that the square of the length of a vector is an orthogonal space is given by the sum of the squares of its components ($L^2 = a^2 + b^2 + c^2 + \cdots$). Although the empirical direction cosines in Table II often differ considerably in magnitude from the hypothesized direction cosines (suggesting they are "out of alignment") the signs of the observed and hypothesized direction cosines agree (suggesting they are in the correct general direction).

In addition to the factor analysis, item analysis was used to provide statistics for each of the subscales and to suggest possible improvements. Table II also sumarizes this data. Subscale means ranged between ±3 points with standard deviations of 2.2 to 3.2 points. Frequency plots showed the data for each subscale to be reasonably normally distributed and in nearly all cases spanned the full range of ±8 points. The alpha reliabilities which provide a measure of the proportion of variance which is due to true differences between subjects closely approximate the communalities in the factor analysis suggesting that the three factor model accounts for essentially all of the meanirgful variance generated by the instrument.

In general those teacher role subscales which were defined by consistent combinations of dimensions which are often considered "desirable" or "undesirable" in teachers were easily identified by students as shown in Table IV. Subscales

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Table IV. Grouping of subscales by level of alpha reliability.

Alpha Reliability	Scale		Description
.72	S10	..P-N..	friendly vs unfriendly
.69	S04	.UF-DB.	active + task oriented vs passive + task avoiding
.67	S11	.PF-NB.	friendly + task oriented vs unfriendly + task avoiding
.61	S03	UPF-DNB	active + friendly + task oriented vs passive + unfriendly + task avoiding
.37 (.54)*	S02	.UP-DN.	active + friendly vs passive + unfriendly
.40	S09	UPB-DNF	active + friendly + task avoiding vs passive + unfriendly + task oriented
.39	S01	..U-D..	active vs passive
.38	S06	.UB-DF.	active + task avoiding vs passive + task oriented
.36	S07	UNB-DPF	active + unfriendly + task avoiding vs passive + friendly + task oriented
.36	S12	..F-B..	task oriented vs task avoiding
.18	S13	.PB-NF.	friendly + task avoiding vs unfriendly + task oriented
.11	S05	UNF-DPB	active + unfriendly + task oriented vs passive + friendly + task avoiding

*Scale reliability with item 28 eliminated

Which represent combinations of conflicting "desirable" and "undesirable" teacher characteristics were poorly identified by students. The moderately reliable scales were those primarily defined by the second and third factors, e.g. U-D, F-B, UB-DF, UNB-DPF, UPB-DNF. This is probably due to the expected teacher role as designated leader of the classroom group. It is unlikely that teachers will be active in the classroom without directing at least some energy to the learning task. Thus, although the pure U-D and F-B roles are not well identified by students, the UF-DB role is. The three subscales which combine active but task avoiding teacher roles or the withdrawn but task oriented roles (UB-DF, UNB-DPF, UPB-DNF) are valid for members of groups in general but are unlikely to be found in teachers at least as defined by the items in the current form of this instrument.

Implications and Comments

The results of this study are encouraging for the development of a high inference paper and pencil instrument to provide student perceptions of teacher interpersonal role based on the model proposed by Bales; however, considerable work remains before an instrument with reasonably detailed factor structure is developed. Work is continuing along three directions:

1) It is necessary to define the dominance (U-D) and task orientation (F-B) dimensions in a manner more appropriate to teachers as designated leaders of the classroom group. We are currently experimenting with a definition based on the level of "energy" with which the teacher approaches the class situation. The task orientation dimension (F-B) is being explored in terms of teacher competence in subject matter.

2) It is clear that the current form of the instrument is too long and that the reading level too difficult for most students at the junior

high school level and in many urban settings. A thirteen item instrument is being developed in which students respond on a seven point Likert scale whose extremes are defined by a description of teacher behavior associated with each end of a dipole pair, e.g. U-D, PB-NF, etc. Although this will preclude application of standard reliability measures, the current study has shown that the communality associated with the factor analysis closely approximates the alpha reliability estimates.

3) An effort to improve the specific structure of the empirical factor space is being made by organizing the thirteen items into three groups of increasing complexity. First, the three dipolar dimensions which define the space (P-N, F-B, U-D) are presented. Next, the six items which represent combinations of only two components (PF-NB, PB-NF, UP-DN, UN-DP, UF-DB, UB-DF) are presented. Last, the four items which include all three components (UPF-DNB, UPB-DNF, UNF-DPB, UNB-DPF) are presented. It is hoped that this procedure will help students better understand the relationships of the individual items and thus reduce the confounding of variables. This new format should also considerably reduce the time required to respond to the instrument and make it possible to administer it in a variety of ways including interview techniques with small groups of students with reading problems.

A computer program which scores student responses and provides both summary data and factor plots for each student in a class is currently being debugged for use in the pre-service program at Teachers College - Columbia University. Persons interested in using this system are encouraged to contact the author for further information and materials.

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